



US Army Corps
of Engineers
North Central Division

GREAT LAKES LEVELS

Update Letter No. 89 December 2, 1992

Great Lakes - St. Lawrence River Water Levels Reference Study Nears Completion

The International Joint Commission, a bi-national organization responsible to the Governments of the United States and Canada for transboundary water issues, was directed by the two Governments in August, 1986, to examine and report upon methods of alleviating the adverse consequences of fluctuating water levels in the Great Lakes-St. Lawrence River Basin. The final phase of the Study, under the direction of the Levels Reference Study Board, is nearing completion. The Board will issue its final report to the Commission on March 31, 1993.

Mr. John P. D'Aniello, Director of the Engineering and Planning Directorate, North Central Division, U.S. Army Corps of Engineers, is the U.S. Co-Chair of the Board. The Canadian Co-Chair is Mr. E. Tony Wagner, Regional Director, Inland Waters Directorate, Ontario Region, Environment Canada.

The Board is in the process of consulting with the public and with policy makers on Study findings and conclusions. Meetings with policy makers were held in Indianapolis, Indiana, on October 14; Washington, DC, on November 19; and Hull, Quebec,

on November 24. A series of four public forums has just been conducted the week of November 30 in Thunder Bay, Ontario; Milwaukee, Wisconsin; Sarnia, Ontario; and, Watertown, New York.

A second series of four public forums on the draft Study recommendations will be held the week of February 22, 1993, in Sault Ste. Marie, Ontario; Chicago, Illinois; Buffalo, New York; and, Dorval, Quebec. All of the public and policy forums provide an opportunity for citizens and officials to review the findings of the Study and offer suggestions and comments prior to the development of final Study recommendations.

Major Products of the Study

Four Working Committees have been active since November, 1990, in completing a number of tasks at the direction of the Levels Reference Study Board. These tasks have resulted in work products that respond to the 1986 request from both Governments and to additional guidance provided to the Study Board by the International Joint Commission. The major products

of the Study include:

1. Evaluation of both water level control measures and land use, and shoreline management measures.
2. Emergency responses to extreme low and extreme high water level conditions.
3. Guiding principles for future coordination and management of water levels in the basin.
4. Review of institutional arrangements to facilitate implementation of measures, and to improve future management of water levels in the basin.
5. Information program for government agencies to improve public awareness and knowledge of water levels issues.

The sixth issue of the Water Levels Reference Study newsletter, Update/Au Courant, dated November 6, 1992, describes options that have been developed for consideration on each of these matters. These have been and will be discussed at the public and policy forums, previously described. THE SOURCE FOR THE INFORMATION PROVIDED BELOW IS THE SIXTH ISSUE OF THE STUDY'S UPDATE NEWSLETTER.

Options for Measures To Reduce the Adverse Impacts of Fluctuating Water Levels and Flows

Issue 1 of Update/AuCourant explained the 18 types of measures under consideration. Since then, detailed research was conducted to determine the impacts of these measures, and an evaluation process was carried out to narrow the measures down even further.

The evaluation process rated the measures against four major criteria: 1) Economic and Social; 2) Environmental; 3) Impact Distribution among Interests and Regions; and, 4) Technical, Operational, Legal and Public Policy Feasibility. All 140 members of the Study Team -- including government staff, interest groups, and individual citizens -- were asked to rate the measures according to how well they met the four criteria.

In a September 1992 workshop, attended by more than 70 Study members, tabulations of these ratings were discussed. Agreement was reached upon which measures should be carried forward as options for further examination and possible Government action, and which ones should be dropped from further consideration. Some of the options are modifications or combinations of measures originally considered. Everyone who participated in the rating process worked from a 250-page compendium of data on the measures. Titled "Impacts of Measures for Evaluation: Summary", this book will be further updated and made available upon request early in

1993.

The September workshop results are subject to revision based upon input received from the public forums, from comments received regarding the compendium, and from the final report process. To date, the possible options for government action fall into three broad categories:

1. **Remedial Measures** would, principally, reduce damages to structures that already exist. See Chart 1 for details.

2. **Preventive Measures** would, principally, reduce the probability of activities that could increase future damages. See Chart 2 for details.

3. **Compensatory Measures** would compensate for damages incurred as a result of flooding and erosion damages due to fluctuating levels and flows. See Chart 3 for details.

The Study is developing a range of options for the various major work products. The options developed to date, which are subject to revision based upon public input, are discussed below.

OPTIONS FOR EMERGENCY ACTIONS

There are many possible emergency actions that could be taken to reduce adverse effects during high or low water crises. Some of these could involve little or no additional capital costs, but might involve a transfer of benefits from one interest or geographic area to another.

Hydraulic measures would include a series of controlled

deviations from the flows currently prescribed in the regulation plans of Lakes Superior and Ontario, and at five other sites: the Long Lac and Ogoki Diversions into Lake Superior, the Lake Michigan Diversion at Chicago, the Welland Canal, and the Black Rock Lock in the Niagara River. A series of threshold water levels would call for incremental flow deviations, which would increase with the magnitude of the crisis.

Various land-based measures which are often site-specific might also be brought into effect, along with possible capital cost measures. Included among these would be the following: emergency sandbagging; emergency preparedness plans; storm and water level forecasting and warning networks; disaster assistance; shore protection alternatives; drought assistance; and, temporary land and water use restrictions.

OPTIONS FOR GUIDING PRINCIPLES

The following set of guiding principles could improve understanding, cooperation, coordination, and flexibility in decision making on issues related to Great Lakes-St. Lawrence River levels and flows. These principles are being considered for recommendation to the International Joint Commission.

* Existing and future beneficial uses will be considered, and the fundamental character of the system will not be adversely affected.

* Actions will be environmentally sustained and respect the integrity of the ecosystem.

OPTIONS FOR REMEDIAL MEASURES

Lake Level Regulation

SEO* -- Three Lake Expanded Regulation

This measure would use existing structures in the St. Mary's and St. Lawrence Rivers and add a control structure in the Niagara River. The Niagara would be dredged to increase its capacity to handle higher flows. Dikes and weirs placed in the Detroit River to offset the impact of prior dredging would be removed. Additional works would be required in the St. Lawrence River.

This plan would affect all five lakes by reducing Lake Superior's long-term mean level by 15 centimetres (1/2 foot); reducing the frequency of high levels on Lakes Michigan-Huron; raising Lake Erie's level during low supplies and lowering its level during high supplies; maintaining Lake Ontario's current regime and balancing upstream and downstream requirements during extreme water supply periods; and, maintaining the St. Lawrence River's current regime by adding additional structures.

The object of this plan would be to reduce the range of water level fluctuations as much as possible on Lakes Michigan, Huron and Erie.

SEO -- Three-Lake Combined Regulation

This possible regulation plan would also affect all five lakes. It differs from SEO Expanded in that it would be operated to achieve maximum benefits for a number of interest groups: Riparian, Recreational Boating, Hydro Power, Navigation and the Environment. This measure would require addition of a control structure in the Niagara River, together with dredging and other modifications in the Niagara and St. Lawrence Rivers. This measure considers interests only as far downstream as Montreal. It does not include objectives for interests below Montreal to Trois Rivières, Quebec.

SO -- Lake Ontario Combined, Including Environment

This plan would use only the existing regulation structures on Lakes Superior and Ontario. Lake Superior's regulation plan would be unchanged, while Lake Ontario's regulation plan would be modified to operate without current International Joint Commission constraints. It would reflect the preferred ranges of levels and flows for riparians, recreational boating, hydropower, commercial navigation and environmental interests, within the present capacities of the regulation structures and the St. Lawrence River.

SO -- Two Lake Combined, Superior 1/2 ft., Ontario Plan 1958D*, Modification 35K* with Deviation

This plan would reduce the mean and target minimum levels (while increasing the range of fluctuation) of Lake Superior by 15 centimetres (1/2 foot) in order to reduce the range of fluctuation of Lakes Michigan-Huron. No new structures would be required, but Lake Superior harbours, channels and tributary mouths would require dredging to allow for the 15 centimetre lowering of the minimum lake level. Among other things, Modification 35K would modify seasonal outflow adjustments from Lake Ontario to better balance the needs of upstream recreational boaters with downstream commercial navigation and recreational boating. The reference to "with deviation" means that this plan would retain its current allowances for discretionary departures from the prescribed outflows, under extreme conditions.

SO -- Superior Plan 1977A* Modified With Ontario Plan 1958D Modification 28B*

This plan would call for fine-tuning of existing regulation plans to increase the maximum winter outflow from Lake Superior and modify the equation that balances Lake Superior and Lakes Michigan-Huron Levels. It would also include modifications to Lake Ontario's regulation plan to better satisfy upstream recreational boaters with some negative impacts downstream for recreational boaters and commercial navigation. This modification would also reduce spring flooding in the Montreal area (See Plan 1958D With Modification 28B).

Plan 1977A Without Criterion C -- This measure would modify current regulation to Lake Superior to allow more flexibility in the balancing of levels between Lake Superior and Lakes Michigan and Huron. Criterion C requires that once Lake Superior's level falls below 183.0 metres (600.5 feet), the outflow from the lake must be no greater than it would have been prior to the addition of structures in the St. Mary's River. Elimination of Criterion C would allow flows higher than those currently specified for low Lake Superior levels. The amount of flow would depend upon upstream and downstream conditions.

Plan 1958D With Modification 28B -- This modification would change the current Lake Ontario regulation plan to consider all interests. Seasonal adjustments to flows would better meet the needs of recreational boaters upstream of Cornwall-Massena in the St. Lawrence River, with some detriment to recreation and commercial navigation downstream. This plan would also incorporate discharge of more water in times of high winter supplies, when ice conditions permit. As well, the plan limits Lake Ontario outflows to reduce spring flooding in the Montreal area.

Plan 1958D With Modification 35K* -- This plan differs from Modification 28B in that it has different seasonal adjustments, and modified minimum flow limits in the fall months. These tend to improve upon Modification 28B in terms of improving the balance in upstream and downstream levels for recreational boating and commercial navigation, while they maintain 28B's other characteristics.

**The following conventions are used in describing lake level regulation plans:*

SEO -- Refers to regulation on Lakes Superior, Erie and Ontario

SO -- Refers to regulation on Lakes Superior and Ontario

Plan 1977A -- Refers to the current plan for regulating Lake Superior

Plan 1958D -- Refers to the current plan for regulating Lake Ontario

Modifications 28B and 35K -- Two of many possible modifications that have been modelled for Lake Ontario's regulation plan. The numbers, 28B and 35K, indicate the sequence in which they were developed.

BOC -- Refers to the "basis of comparison", which is a set of "current condition" water levels and flows that are used as a reference for assessing the impacts of modified lake regulation and crisis management plans. The BOC is calculated for the 90-year period from 1900-1989, and it gives the water levels and flows that would have occurred each month of that period if all current regulation plans, current channels and existing diversions had been in effect over the period. Water supplies used to calculate the BOC are the supplies that actually occurred (historic supplies) during the 90 years.

Land Based Measures

Acquisition Of Developed Lands In Hazard Zones -- to prevent, or reduce, future property damages and losses, and to encourage communities or agencies to purchase developed property in hazard areas.

Relocation Of Dwellings -- to reduce or avoid flooding or erosion damage by relocating existing structures from hazard areas. Some dwellings could be designed for temporary relocation during extreme conditions.

Flood Proofing Of Existing Structures -- by raising structures above the flood level, by cementing over basement windows, or removing items from the flood-prone area of the structure (i.e., the basement).

Structural Shore Protection To Prevent Flooding -- by constructing dikes and levees as permanent or temporary measures.

Structural Shore Protection To Prevent Erosion -- by constructing breakwaters, barrier islands, sea walls, groins and jetties, revetments, or artificial headlands that would dissipate wave energy or trap sand.

Non-Structural Shore Protection -- by artificial beach nourishment or vegetation to stabilize shoreline areas.

* Actions will be beneficial to the system and not result in undue hardship to any particular interest.

* Coordinated management will respect and accommodate the dynamic nature of the entire system.

* Management of the Great Lakes-St. Lawrence River basin system should be done in full awareness of the potential for reduced water supplies as a result of climate change.

* Decision making with respect to management of the system will be open, respecting the full range of interests affected by decisions, and facilitating their participation in the policy process.

* Management of the Great Lakes-St. Lawrence River basin system will be based on coordination of actions relating to levels and flows.

* Management of the Great Lakes-St. Lawrence River basin system will be based on continued improvements in the understanding of the processes and impacts of fluctuating water levels and flows.

* Management of the Great Lakes-St. Lawrence River basin system requires ongoing communication and public awareness.

OPTIONS FOR COMMUNICATIONS PRACTICES

To Improve Public Knowledge of Water Level Issues

The results of a survey of 65 users of water level information reveal that certain user groups (coastal engineers, government emergency workers, recreational boaters and marina operators, and shoreline property owners)

Chart 2 Options for Preventive Measures

Setback Requirements -- specify location of structures outside flood or erosion prone areas.

Flood Elevation Requirements -- specify construction of new structures above the flood elevation.

Shoreline Alteration Requirements -- prevent changes to the shoreline that could interfere with shore process in neighboring properties.

Real Estate Disclosure Requirements -- require notice to prospective buyers of property in potential flood and erosion hazard areas.

Development Controls For Public Infrastructure -- require design and location of public infrastructure (roads, sewer and water lines) outside of hazard areas, in order to avoid or minimize future damage by discouraging development in such areas.

Acquisition of Undeveloped Land and Habitat Protection -- prevent future development of hazarded lands by allowing government purchase of such land for public access space or protected natural habitat.

Chart 3 Options for Compensatory Measures

Disaster Aid -- would provide financial relief to assist with repair of damages caused by extreme water levels.

Tax Relief -- would lessen the tax burden on those who have suffered damage or loss of property due to extreme water levels.

Insurance -- would provide coverage, upon purchase, for losses incurred due to extreme water levels.

find deficiencies in the information services they currently receive.

The results suggest a strategy for improving the quality and communication of water level information that involves:

1) developing better decision making tools for action in extreme water level conditions;

2) small changes to water level bulletins distributed by the Canadian and U.S. Governments to make them more understandable; and,

3) tailoring existing information to users' needs.

Such a strategy could be undertaken in concert with a Water Level Communications Clearinghouse. This clearinghouse would coordinate and promote information about Great Lakes-St. Lawrence River water levels to specific interest groups and to the general public.

Options for establishing such a clearinghouse include locating it at the International Joint Commission's regional office in Windsor, Ontario; making it a bi-national effort by universities or governments; or, making it a bi-national project of an agency that is not directly accountable to governments.

OPTIONS FOR INCENTIVES TO IMPLEMENT MEASURES

Several types of taxation or tax assessment practices could be used to encourage individuals to calculate the advantages or disadvantages of locating in a hazard area. Other incentives would be loans and grants to encourage particular courses of action. These incentives would not be implemented as measures

in their own right, rather, they would be used as incentives for the implementation of other measures.

OPTIONS FOR INSTITUTIONAL ARRANGEMENTS

To Facilitate Implementation of Measures

Nearly all of the options for government actions require some form of arrangements between or among the many agencies and institutions that currently deal with water level issues.

For example, water level regulation plans, or modifications to plans, would require International Joint Commission approval, as well as agreement of the parties responsible for various aspects of the current lake level regulation process. A coordinated effort would also be required to ensure their continued responsiveness to users' needs.

Land based measures might require legislation, bylaws, and coordinated planning among federal, state/provincial, and local governments.

Plans to respond to high or low water level crises would require coordination among various agencies as well.

Meanwhile, strategies to implement improved communications practices with the general public would also require a considerable amount of inter-agency cooperation.

Several options are presented as changes to the existing structures of International Joint Commission Boards. The object of these options is to allow improved communication among the boards, and increased

responsiveness to the various interests. One means of improving responsiveness would be to allow citizen membership on the boards. These options are to stimulate discussion and should not be viewed as the only options available.

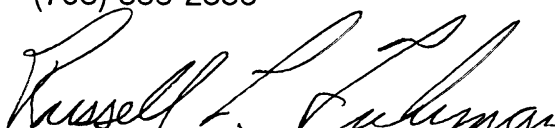
FULL DETAILS ON OPTIONS AVAILABLE FROM CONTACTS

If you would like to review in more detail the options that have been outlined here, get in touch with one of the contacts listed below. The complete, 75-page "Options Document" is available on request.

Direct your comments and enquiries to:

In Canada:
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Great Lakes Basin Hydrology

The precipitation, water supplies, and outflows for the lakes are provided in Table 1. Precipitation data include the provisional values for the past month and the year-to-date and long-term averages. The provisional and long-term average water supplies and outflows are also shown.

Table 1
Great Lakes Hydrology¹

PRECIPITATION								
BASIN	NOVEMBER				YEAR-TO-DATE			
	1992 [*]	AVG. ^{**}	DIFF.	% OF AVG.	1992 [*]	AVG. ^{**}	DIFF.	% OF AVG.
Superior	2.4	2.5	-0.1	96	28.4	28.2	0.2	101
Michigan-Huron	5.0	2.7	2.3	185	31.1	29.6	1.5	105
Erie	5.4	2.8	2.6	193	39.2	32.3	6.9	121
Ontario	4.3	3.1	1.2	139	36.4	32.2	4.2	113
Great Lakes	4.2	2.7	1.5	156	32.1	29.9	2.2	107

LAKE	NOVEMBER WATER SUPPLIES ^{***}		NOVEMBER OUTFLOW ³	
	1992 ²	AVG. ⁴	1992 ²	AVG. ⁴
Superior	50,000	18,000	79,000	80,000
Michigan-Huron	228,000	36,000	184,000 ⁵	190,000
Erie	91,000	-5,000 ^{***}	225,000 ⁵	199,000
Ontario	77,000	20,000	293,000	236,000

^{*}Estimated (inches)

^{**}1900-90 Average (inches)

^{***}Negative water supply denotes evaporation from lake exceeded runoff from local basin.

¹Values (excluding averages) are based on preliminary computations.

²Cubic Feet Per Second (cfs)

³Does not include diversions

⁴1900-89 Average (cfs)

⁵Reflects effects of ice/weed retardation in the connecting channels.

For Great Lakes basin technical assistance or information, please contact one of the following Corps of Engineers District Offices:

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